Heat Transport and Overturning Circulation in 0.1°, 0.2° and 0.4° Simulations of the North Atlantic Ocean

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A suite of simulations of the North Atlantic Ocean has been conducted at horizontal resolutions of 0.1°, 0.2° and 0.4° with the aim of understanding the effects of resolution on eddy variability and on the mean wind-driven and thermohaline circulation. The model configuration, initial condition, and surface forcing were identical in the three runs. As reported in Smith et al. (2000) the 0.1° case shows remarkable improvements in both the eddy variability and wind-driven circulation relative to eddy-permitting simulations in the range of 1/2° to 1/6°. In this study we focus on aspects of the thermohaline circulation, including meridional heat transport, overturning circulation, and the formation and pathways of deep water at high latitudes, in order to elucidate some of the mechanisms responsible for the increase in meridional heat transport with increasing model resolution. This increase is primarily due to stronger meridional overturning circulation, which results from improved representation of the sources and pathways of cold deep waters that flow over the sills between Greenland and Scotland. Very high resolution appears to be needed in order to accurately represent the overflow of cold waters through the narrow sills at Denmark Strait and the Faroe Bank Channel, and to simulate the detailed pathways of the cold water as it circulates through the Irminger and Labrador Seas, around the Grand Banks and proceeds south in the DWBC.

Reference

Smith, R.D., M.E. Maltrud, F.O. Bryan, and M.W. Hecht 2000. Numerical simulation of the North Atlantic Ocean at 1/10°. *JPO* 30, 1532-1561.